

PHYTOTOXICOLOGY MOSS BAG
ASSESSMENT SURVEY
IN THE VICINITY OF
UNIVERSAL TERMINAL LTD.
MATILDA TWP.
SEPTEMBER 1989 THROUGH
APRIL 1990

JUNE 1991



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**Phytotoxicology Moss Bag Assessment Survey
in the Vicinity of Universal Terminal Ltd., Matilda Twp.
- September 1989 through April 1990**

BACKGROUND

Since 1985, four separate moss bag surveys have been conducted in the vicinity of the Universal Terminal Ltd. (UTL) salt storage pad in Matilda Township near Iroquois, Ontario. The most recent survey was conducted from fall through winter during 1989/1990. The surveys were conducted to determine the status of salt emissions associated with the off-loading of salt from boats and salt pile removal operations at UTL. Previous moss bag surveys (reports ARB-152-86-Phyto; ARB-158-87-Phyto; ARB-163-88-Phyto) indicated that the off-loading activities at UTL in the fall, and the salt pile removal operations (truck loading, truck traffic) through fall and winter, can result in significant off-site contamination. The previous data further indicated that the deicing salt applications to Lakeshore Drive during the winter also can be a significant salt source. The surveys were requested by MOE staff, Cornwall.

1989-1990 MOSS BAG SURVEY

Moss bags consist of laboratory-prepared sphagnum moss wrapped in a polypropylene mesh bag. They are used as biomonitors near emission sources because they trap and retain airborne contaminants.

On September 19, 1989, single moss bags were placed at a height of about 3 meters at 8 regular stations established in previous years. Sites 2, 5, 8, 11 and 13 were situated on the road allowance, while Sites 9, 10 and 12 were located on residential properties more remote from Lakeshore Drive. The sites were situated at increasing distances to the west and east of the UTL salt storage pad (see attached Figure 2).

The bags were exchanged at two week intervals through to April 1990 by Cornwall MOE staff. Following exchange, the moss bags were inserted in separate paper bags and were stored at the Cornwall MOE office until delivery by Purolator to the Phytotoxicology Section, 880 Bay St., Toronto. They were received by R. Emerson who submitted them for processing to the Phytotoxicology Laboratory. Here, the sphagnum moss was removed from each mesh bag and was air dried, ground and stored in glass bottles. The moss samples were then submitted to the MOE Laboratory Services Branch, Resources Rd., Toronto, for analysis of sodium (Na) and chloride (Cl).

OTHER RELEVANT INFORMATION

As indicated in the attached documentation (MOE memorandum: Taylor to Emerson August 21, 1990), five boat shipments of salt were unloaded on UTL's asphalt salt storage pad between September 26 and November 3, 1989. The salt inventory was removed from the UTL property, using tractor trailer trucks and a large front-end loader, between September 26, 1989 and April 30, 1990. Also shown are the dates on which deicing salt was applied to Lakeshore Drive. The deicing salt applications to the road did not start until almost two weeks after the final (boat) shipment was off-loaded at UTL.

ANALYTICAL RESULTS

The moss bag chemical analysis results are summarized in the attached table. The results for the boat unloading period (Sept. 19 - Nov. 3, 1989) revealed that three of the four moss bag exposures

had elevated concentrations of Cl and Na at sites in the immediate vicinity of the UTL salt storage pad. The highest concentrations were detected during the initial exposure at Site 2 (Cl 17000 ppm; Na 13000 ppm) to the immediate east of UTL. The next highest levels were detected during the third exposure at Site 12 (Cl 6300 ppm; Na 7300 ppm) to the immediate west-southwest. The highest concentrations of Cl and Na (Site 2) were 141 and 67 times higher than the corresponding means for remote Sites 8, 11 and 13 (120 & 190 ppm). Because only lower Cl and Na levels were found at the remote sites, the elevated levels found in the close proximity to UTL were considered to be related to operations at UTL. Further, the fact that salt levels at sites closest to UTL declined immediately following the boat unloading period indicates that the boat off-loading operations were likely the primary source of the off-site contamination.

Some exposures following the salt unloading period also revealed a pattern of generally higher salt levels at sites close to UTL, particularly the exposure period from Jan. 23 to Feb. 6, 1990. During this exposure, Cl concentrations were high at Sites 9 and 10 to the east, especially Site 9 (Cl 52000 ppm). However, this level may be anomalous because it is very much out of context relative to the other Cl results for the same exposure period. It is also the highest Cl level ever detected in the survey area. Nevertheless, the fact that the Cl level at neighbouring Site 10 (3400 ppm) also was elevated during the same exposure, suggests that UTL operations (e.g. truck loading operations) had contributed to the elevation.

During November 14, 1989 through March 6, 1990, salt concentrations in moss were elevated at most sites including sites more remote from UTL. This implicates the deicing salt applications to Lakeshore Drive as an additional local source of salt contamination. During the exposure from March 6 to 20, no deicing salt was applied to Lakeshore Drive and salt concentrations in the moss bags sharply declined. This further substantiates road salting contributions to the elevated Cl and Na levels which were found throughout the survey area during the late fall and winter.

The attached bar graph (Figure 1) compares the mean Na concentration for all sites close to UTL to that for remote Sites 8, 11 and 13 for both the boat off-loading period and for the salt pile removal period during which deicing salt was applied to Lakeshore Drive. This figure further implicates the boat off-loading at UTL as being responsible for the elevated moss bag salt concentrations found during the early part of the study period. It also illustrates that the elevation found after the boat unloading period was largely related to the winter deicing salt applications to Lakeshore Road.

Several of the highest Cl and Na concentrations found during this survey were the highest to be detected since the initial 1985 survey. The highest levels detected in previous surveys were 4400 ppm Cl and 2600 ppm Na.

SUMMARY

The results of the 1989/90 moss bag survey concluded that salt emissions from the boat off-loading and, to a lesser extent, salt pile removal operations at UTL can result in significant off-site contamination. The deicing salt applications to Lakeshore Drive during the late fall and winter also were found to be a significant salt source. The Cl and Na concentrations detected in 1989/1990 were the highest since the UTL moss bag survey began in 1985.

LITERATURE CITED

Phytotoxicology Investigations in the Vicinity of the Universal Terminal Ltd. (UTL) Salt Storage Pad, Iroquois - 1984 & 1985 (ARB-152-86-Phyto)

Phytotoxicology Moss Bag Assessment Survey in the Vicinity of Universal Terminal Ltd., Iroquois - September, 1986 through April, 1987 (ARB-158-87-Phyto)

Phytotoxicology Moss Bag Assessment Survey in the Vicinity of Universal Terminal Ltd., Iroquois - October 1987 through February 1988 (ARB-163-88-Phyto)

**Moss Bag Concentrations of Chloride and Sodium Detected in the UTL Survey Area
- Sept. 19, 1989 Through Apr. 3, 1990**

Exposure Period	Sites West of UTL			Sites East of UTL				
	5 150 m*	12 150 m	8 1.1 km	2 500 m	9 600 m	10 625 m	11 1.3 km	13 1.3 km
<u>Boat (Salt) Unloading/Trucking Started Sept. 26, 1989</u>								
Sept. 19 - Oct. 3/89	Cl	1800	420	IS	17000	280	IS	120
	Na	410	320	210	13000	240	490	160
Oct. 3 - 17	Cl	120	280	120	210	260	280	20
	Na	140	270	140	380	270	560	52
Oct. 17 - 31	Cl	2390	6300	IS	430	5800	540	700
	Na	3700	7300	160	360	210	350	100
Oct. 31 - Nov. 14	Cl	2200	1100	100	1220	IS	700	120
	Na	1400	780	140	1100	410	550	260
<u>Boat Unloading Stopped Nov. 3, 1989; Trucking Cont'd to Apr. 30, 1990</u>								
Nov 14. - 29	Cl	140	340	660	670	280	IS	IS
	Na	210	290	470	670	310	340	380
Nov. 29 - Dec. 12	Cl	4900	IS	1700	2100	620	480	2500
	Na	2800	3400	820	1200	460	390	1400

Continued

**Moss Bag Concentrations of Chloride and Sodium Detected in the UTL Survey Area
- Sept. 19, 1989 Through Apr. 3, 1990**

Exposure Period	Sites West of UTL				Sites East of UTL						
	5 150 m	12 150 m	8 1.1 km	2 500 m	9 600 m	10 625 m	11 1.3 km	13 1.3 km			
Dec. 12 - 27											
		Cl	1500	640	1100	800	350	780	1300	1100	
		Na	890	470	730	730	450	550	900	830	
Dec. 27 - Jan. 9/90											
		Cl	3600	1200	2400	IS	460	360	3500	3500	
		Na	1800	670	1200	2700	340	200	1800	2200	
Jan. 9 - 23											
		Cl	840	920	320	540	280	IS	420	520	
		Na	660	600	190	280	140	380	320	300	
Jan. 23 - Feb. 6											
		Cl	1000	520	1000	700	52000	3400	1200	IS	
		Na	590	240	260	530	3700	440	800	330	
Feb. 6 - 23											
		Cl	260	220	240	280	120	260	20	280	
		Na	210	100	260	290	180	170	210	510	
Feb. 23 - Mar. 6											
		Cl	2300	600	900	1500	600	540	1200	1400	
		Na	1300	520	690	1000	520	540	890	850	
Mar. 6 - 20											
		Cl	220	140	180	200	140	240	100	220	
		Na	260	240	230	240	210	220	210	190	
Mar. 20 - Apr. 3											
		Cl	120	NS	160	100	120	80	80	180	
		Na	150	NS	140	110	160	160	120	190	

* Approximate distance from UTL salt pad
IS - insufficient sample NS - No sample received

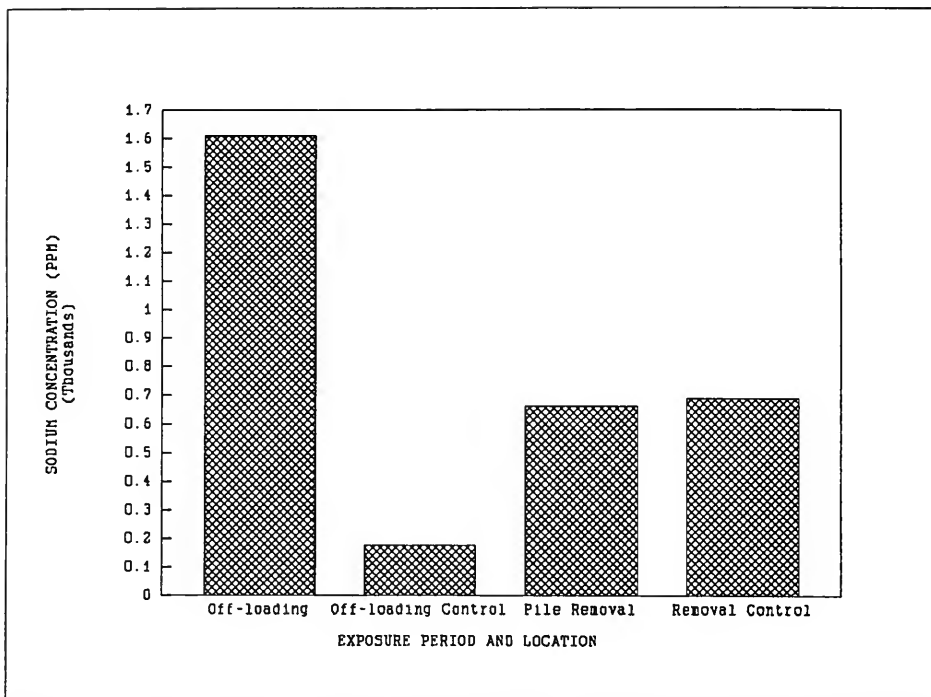


Figure 1 Moss Bag Sodium Means for Sites Close to UTL Versus Control Sites (8, 11 & 13) for Boat Off-Loading Exposures (Sept. 19 - Nov. 14/89) and for Salt Pile Removal Period (Nov. 14/89 - Apr. 3/90)

Figure 2: Approximate Moss Bag Locations In Relation to UTL Salt Storage Pad: 1986 - 1990

